

AMENDMENTS TO THE SPECIFICATION:

Please replace the paragraph that beings on Page 2, line 12 with the follow replacement paragraph:

Recognizing the foregoing problems, to enhance image storage stability of ink-jet recording images, many proposals have been disclosed. For example, as an ink-jet recording medium, an accomplishment is described in Japanese Patent Application Publication Nos. 59-222381, 4-21446, 10-315448, 11-5362 and 11-192775 (hereinafter, referred to as JP-A Nos.) ~~are accomplishment~~ to improve water resistance and weather resistance and to provide image glossiness during formation of a high polymer protective coating, which is prepared with a layer comprising thermoplastic organic polymer particles provided that the outermost layer of the recording medium, and the thermoplastic organic polymer particles are melted to form a film layer after image recording.

Please replace the paragraph that beings on Page 3, line 3 with the following replacement paragraph:

However, in the technologies ~~describe~~ described in the foregoing official ~~publication~~ publications, there are some insufficient points in some characteristic criteria. Firstly, scratch resistance is insufficient. The images described in the above publications exhibit preferable image quality, due to enhanced glossiness with formation of a resin layer, but on the other hand, the surface is easily scratched and the scratches tend to be highly visible, ~~while~~ which calls for improvement. Secondly, print cracking resistance is also not adequate. Specifically, the problem is that images suffer cracking in portion or the total area in cases when images are stored for relatively long periods or are exposed to high temperature and humidity conditions. Thirdly, scratch resistance under high humidity is insufficient. This is a phenomenon in which images or layers can be easily peeled off by simple finger rubbing when wet. For example, when images wetted by spilled water or coffee, or by rain when viewed outdoors, the images or the layers may be peeled off when wiped. ~~These problems are more serious when~~ When images are printed with pigment ink, which printing

recently has spread rapidly, these problems are more serious. In addition, when printed with pigment ink, pigment does not permeate, or only slightly permeates into the deeper portions of the recording medium as is the case with dye ink. Accordingly, expression of glossiness may be insufficient, or the bronzing phenomenon may result. It is desired to overcome these problems.

Please replace the paragraph that beings on Page 4, line 5 with the follow replacement paragraph:

On the other hand, ~~proposed~~ is a method of a pressurizing treatment of a layer containing thermoplastic organic polymer particles after image recording is proposed (for example, in Patent Document 1). However, considering the results of the Examples, there is no layer thickness change between before and after the pressurizing treatment, and thus, the need for compressing the layer thickness cannot be specifically identified.

Please replace the paragraph that beings on Page 4, line 13 with the follow replacement paragraph:

Further, a method to make a layer non-porous by a heating process, in which a layer comprising a thermoplastic resin at a void ratio of 15 – 40% is proposed (for example, in Patent Document 2). However, in this method, only a heating process is mentioned, ~~and neither~~ not compression of the layer thickness by providing a pressurizing treatment, ~~and the~~. And the degree of compressing the surface layer is not described at all.

Please replace the paragraph that beings on Page 4, line 21 with the follow replacement paragraph:

Further, methods to add a specific amount of an inorganic pigment to a thermoplastic resin containing layer are described (for example, in Patent Documents 3 - 5). However, ~~not at all~~ described in any of these methods, is compression of the layer thickness with a pressurizing treatment nor the degree of the surface layer compression.

Please replace the paragraph that beings on Page 6, line 3 with the follow re-
placement paragraph:

(1) A method of forming an ink-jet image, comprising
the steps of:

ejecting droplets of an ink onto an ink-jet recording
media which includes a support having thereon an outer-
most layer containing a thermoplastic resin; and then

applying pressure onto the outermost layer with a
pressing apparatus so that a thickness of the outermost
layer after applying pressure is 50 to 80% of the outermost
layer before ~~being applied~~ applying pressure.

Please replace the paragraph that beings on Page 7, line 9 with the follow re-
placement paragraph:

(7) The method of forming an ink-jet image of item 1,
wherein the support is non-water-~~absorptive~~ absorptive.

Please insert the following paragraphs before the paragraph that begins on page 8,
line 12 of the specification:

Explanation of Fig. 1 and Fig. 2

Fig. 1 is a schematic view showing one example of the
structure of an ink-jet recording apparatus employed in the
present invention. In Fig. 1, recording material 1 fed, from
paired transport rollers 21 is subjected to ink-jet recording
at printing stage 34, employing printing head 3 and is then
cut to a desired size, employing cutter 61 and cutter 62.
The resultant cut material is conveyed to first paired roll-
ers 71 and then to second paired rollers 72 in a suspended
state 1a.

Number 2 indicates a transport means, number 5 indicates a
thermal sensor, number 6 indicates a cutting means and
number 7 indicates a suspended state forming means.

Subsequently, said material is conveyed to thermal fixing means 4 and passed and then passed between heating roller 41, comprising heating body 43 in its interior, and pressure roller 42.

Fig. 2 is a schematic view showing another example of the structure of the ink-jet recording apparatus employed in the present invention. In Fig 2, recording material 1 fed from paired transport rollers 21 is subjected to ink-jet recording at printing stage 34, employing printing head 3 and is then cut to a desired size, employing cutter 61 and cutter 62. The resultant cut material is conveyed to first paired rollers 71 and then to second paired rollers 72 in a suspended state 1a. Number 2 indicates a transport means, number 5 indicates a thermal sensor, number 6 indicates a cutting means and number 7 indicates a suspended state forming means.

Subsequently, said material is conveyed to thermal fixing means 4, and then passed between heating roller 41, comprising heating body 43 in its interior, and pressure roller 42 together with fixing belt 44, second fixing belt 45 and driven roller 46, whereby a thermal fixing treatment is carried out.

Please replace the paragraph that begins on Page 9, line 10 with the following replacement paragraph:

When the compression is 85 to 100% (no compression), scratching resistance under normal or high ~~humid condition~~ humidity conditions and cracking resistance under high ~~humid condition~~ humidity conditions are smaller. These properties may damage the image quality.

Please replace the paragraph that begins on page 9, line 18 with the following replacement paragraph:

In this invention, the surface layer containing a thermoplastic resin preferably has an appropriate void ratio to effectively absorb ink during ink-jet recording and to enable adequate pressurizing in a-p

~~ost pressurizing~~ post-pressurizing process. The reason that the thickness of the surface layer containing a thermoplastic resin can be compressed in this invention is based on the fact that a portion or the total void area can be compressed. With compression of the void area in the range of 50 – 80%, surface uniformity and smoothness are greatly enhanced, and also slippage property is increased, resulting in the advantage to allow a force to escape from generation of scratch at surface. It is assumed that scratch resistance is enhanced as a result. Further, it is also assumed that by compression of the void area beyond a specified level as mentioned above, water and moisture tend to barely permeate, resulting in enhancement of scratch resistance under high humidity, and also resulting in reduced image cracking after long storage, specifically under conditions of high temperature and high humidity. However, excessive ~~compression~~ compression, so that the thickness is compressed more than 50%, may cause excessive stress on the recording medium to generate waviness undulations, or a roughened surface, resulting in lowered glossiness. Therefore, excessive compression is to be avoided.

Please replace the paragraph that begins on page 10, line 20 with the following replacement paragraph:

The compression of the void area to achieve the ratio 70 – 80% based on the initial volume is more preferred. By achieving the ratio 70 – 80%, the scratch resistance under normal humidity and under high humidity is enhanced and image cracking after long storage, specifically under conditions of high temperature and high ~~humidity~~ humidity, is reduced.

Please replace the paragraph that begins on page 11, line 3 with the following replacement paragraph:

Further, in the ink-jet image forming method of this invention, the surface layer containing a thermoplastic resin is ~~preferable to preferably further contain~~ contains a filler, a so-called inorganic pigment, and further, it is preferable that the ratio (B/FB:F) of a thermoplastic resin (B) and a filler (F) is ~~2/8—8/2~~ 2:8 – 8:2.

Please replace the paragraph that begins on page 11, line 9 with the following replacement paragraph:

By containing a filler in the surface layer containing a thermoplastic resin, large beneficial effects may be achieved to prevent color bleeding and beading which are common factors of image quality deterioration. In addition, ~~enhanced may be~~ releasability between the pressurizing apparatus and the recording medium surface during compression of the surface layer may be enhanced. Further, ~~it containing a filler in the surface layer containing a thermoplastic resin~~ is preferable from the viewpoint of scratch resistance, scratch resistance under high humidity, and image cracking resistance after long term storage, specifically under the conditions of high temperature and high humidity. It is assumed that these desirable effects are the result of increased film strength which is obtained by mixing a filler in the surface layer containing a thermoplastic resin.

Please replace the paragraph that begins on page 12, line 5 with the following replacement paragraph:

The surface layer containing a thermoplastic resin in this invention, as mentioned above, is necessary to have the appropriate void ratio to effectively absorb ejected ink and to allow adequate pressurization in the post-process. Specifically, to achieve an average void ratio of the total ink absorbing layer to more than 40%, generation of color bleeding and beading may be effectively prevented, which may be one of the factors leading to deteriorated image quality. Further, it is also a preferable embodiment to compress the surface layer, which characterizes this invention. However, in cases when the average void ratio of the total ink absorbing layer exceeds 70%, it tends to promote failures (such as cracking) specifically during the coating or drying process in recording medium production, which is not preferable due to lowered productivity. Further, the average void ratio of more than 70% is also not preferable because it may cause folding and cracking. Additionally, by setting the average void ratio of the total ink absorbing layer in the above range, generation of image cracking during long term storage, specifically under conditions of high temperature and high ~~humidity~~ humidity, may be prevented.

Please replace the paragraph that begins on page 14, line 1 with the following replacement paragraph:

Further, in the ink-jet image forming method of this invention, the ink-jet recording medium is preferably coated onto a non-water permeable support (or non-water absorptive support).

Please replace the paragraph that begins on page 14, line 5 with the following replacement paragraph:

With the ink-jet image forming method of this invention, photographic-like images exhibiting high quality, high gloss and ~~superiority in~~ superior image stability and surface ~~property~~ properties can be obtained, and to that end, specifically preferred is coating the ink absorbing layer onto a non-water permeable support having excellent smoothness and uniformity. Further, by employing the non-water permeable support which is barely affected by effects of moisture and vapor from the reverse side, the preferable surface layer is formed, which maintains its desirable characteristics for a long period.

Please replace the paragraph that begins on page 14, line 15 with the following replacement paragraph:

Furthermore, in the ink-jet image forming method of this invention, the pressurizing conditions during the pressurizing process after printing employing an ink-jet method are preferably 0.5 – 10 MPa, to provide high gloss and to exhibit beneficial effects of this invention, on varied recording media. In cases when the pressure is less than 0.5 MPa, the surface layer required in this invention cannot be formed. Further, when the pressure exceeds 10 MPa, unevenness of pressurizing results in lowered glossiness at specific areas. Further, depending on environmental conditions during pressurization, the fixing members may be stained with ink-~~component~~ components or peeled-off pieces from the recording medium, and also stress to the fixing device may be increased. Therefore, excess pressure is not preferable due to the difficulty of maintaining stable desirable characteristics over a long period.

Please replace the paragraph that begins on page 21, line 8 with the following replacement paragraph:

Further, thermoplastic micro-particles preferably contain a small amount of residual monomer,[[and]] preferably being less than 3% of the solid mass of the polymer, more preferably less than 1%, and specifically preferably less than 0.1%.

Please replace the paragraph that begins on page 21, line 13 with the following replacement paragraph:

In the surface layer of this invention, a water soluble binder may be incorporated. A water soluble binder may be used in the range of 1 – 10% of the thermoplastic micro-particles. Listed as examples of the water soluble binders are[[:]] polyvinyl alcohol, gelatin, polyethylene oxide, polyvinylpyrrolidone, polyacrylic acid, polyacryl amide, polyurethane, dextran, dextrin, carrageenan (κ , ι , λ), agar, pullulan, water soluble polyvinyl butyral, hydroxyethyl cellulose, and carboxymethyl cellulose. These water soluble resins may be used in combination of more than two kinds.

Please replace the paragraph that begins on page 27, line 2 with the following replacement paragraph:

In this case, the solid weight ratio of thermoplastic micro-particles to the inorganic pigment in the surface layer may be determined individually depending on factors such as the thermoplastic micro-particles, the inorganic pigment and other additive agents, being not specifically limited, however, in this invention, the ratio ($B/FB:F$) of thermoplastic resin (B) and filler (F) is preferably $\frac{2}{8}$ — $\frac{8}{2}$ $\frac{2}{8}$ — $\frac{8}{2}$, more preferably $\frac{3}{7}$ — $\frac{7}{3}$ $\frac{3}{7}$ — $\frac{7}{3}$, and still more preferably $\frac{4}{6}$ — $\frac{6}{4}$ $\frac{4}{6}$ — $\frac{6}{4}$.

Please replace the paragraph that begins on page 27, line 10 with the following replacement paragraph:

The surface layer of this invention may contain a cationic water soluble polymer having a quaternary ammonium base group in the molecule, which is generally used at 0.1 – 10 g

per ~~m²~~ m² of the ink-jet recording sheet, and preferably used in the range of 0.2 – 5 g.

Please replace the paragraph that begins on page 28, line 3 with the following replacement paragraph:

Generally, an ink absorbing layer is divided mainly into two types, a swelling and a void type. A void type layer is formed by coating[[of]] a water soluble binder alone or in a combination of ~~them~~ water soluble binders, such as gelatin, polyvinyl alcohol, polyvinyl pyrrolidone, and polyethylene oxide, to obtain an ink absorbing layer.

Please replace the paragraph that begins on page 36, line 9 with the following replacement paragraph:

Next, polyolefin resin which covers both sides of the paper will now be described. Examples of polyolefin resins used for this purpose include polyethylene, polypropylene, and polyisobutylene. A type of polyolefin such as a copolymer comprising[[of]] mainly propylene is preferable, and polyethylene is specifically preferable.

Please replace the paragraph that begins on page 37, line 15 with the following replacement paragraph:

The utilized amount of polyethylene providing on the front or rear surface of the raw paper base is chosen to optimize the thickness of the ink absorbing layer and minimize curling at low humidity as well as high humidity after providing a backing layer. The thickness of the polyethylene layer on the ink absorbing layer side is usually 15 - 50 μm , and that of the polyethylene layer on the backing layer side is usually in the range of 10 - 40 μm . The ratio of polyethylene on the front and rear sides is optimally chosen to minimize curling, which may vary with the kind and thickness of the ink absorbing layer and the thickness of the raw paper base. Generally the thickness ratio of the ~~front/rear~~ front:rear side is respectively ~~3/1—1/3~~ 3:1 – 1:3.

Please replace the paragraph that begins on page 39, line 6 with the following replacement paragraph:

In the ink-jet image forming method of this invention, various ~~well-known~~ types of ink well-known in the art such as dye ink, pigment ink, and dispersion ink may be employed. Employment of pigment ink is specifically preferred.

Please replace the paragraph that begins on page 44, line 16 with the following replacement paragraph:

A water soluble organic solvent may be used alone or in combination ~~of several kinds~~ with other water soluble organic solvents. The added amount of a water soluble solvent in ink is 5 – 60 weight% as the total amount, and is preferably 10 – 35 weight%.

Please replace the paragraph that begins on page 48, line 8 with the following replacement paragraph:

Employed as pressure rollers, can be metallic rollers made of a metal or a roller in which ~~metal-cored~~ a metal cored bar is covered with an elastic body as a covering layer, and a surface layer (also referred to as a releasing layer) if necessary. The metal cored bar is comprised of, for example, a circular cylinder made of iron, aluminum or stainless steel. Onto the surface of the metal cored bar, a covering layer is provided. As a covering layer, an elastic body having high heat resistance can be employed, and, for example, a HTV (High Temperature Vulcanization) silicone rubber featuring 45° rubber hardness is formed to a desired thickness. Other materials can of course also be employed. On the covering layer, a releasing layer is provided, and used as a covering may, for example, be addition of a RTV (Room Temperature Vulcanization) silicone rubber, a fluorine-contained rubber such as Viton, and a fluorine-contained resin such as PFA (perfluoroalkoxyvinyl ether copolymer resin), PTFE (polytetrafluoroethylene), and FEP (ethylene tetrafluoride-propylene hexafluoride copolymer resin).

Please replace the paragraph that begins on page 49, line 10 with the following replacement paragraph:

In this invention, surface roughness of the pressurizing process member contacting the printing surface, is preferably 200 nm or less. This is easily achieved by polishing the

foregoing metal roller surface to obtain the desired surface roughness, or by forming controlling accuracy of the covering layer or the surface layer covering the metal-~~cored~~ cored bar surface.

Please replace the paragraph that begins on page 52, line 1 with the following replacement paragraph:

For example, with a method of transferring the recording medium between the heating rollers and the pressure rollers, which provide heating elements in the metal-~~cored~~ cored bar interior of the foregoing pressurizing rollers, a heating treatment and a pressurizing treatment may be affected at the same time, or the recording medium may be nipped to be heated between the two heating rollers. In the roller, a heating element such as a halogen lamp heater, a ceramic heater or a nichrome wire heating element may be incorporated. The roller is preferably made from an excellent heat conductive material, and specifically a metallic roller is preferable. The roller surface is preferably coated with a fluorine-contained resin to prevent staining. In addition, a silicone rubber roller covered with heat resisting silicone may be employed.

Please replace the paragraph that begins on page 53, line 16 with the following replacement paragraph:

Using a ~~Jet Stream Inductor Mixer~~ JET STREAM · INDUCTOR MIXER TDS manufactured by Mitamura Riken Kogyo Co., Ltd., 125 Kg of gas phase method silica was dispersed by suction into 620 L of water adjusted to pH of 2.5 with nitric acid at room temperature, after which the total amount was brought to 694 L with water.

Please replace the paragraph that begins on page 63, line 3 with the following replacement paragraph:

All of the foregoing additives were mixed with each other and dispersed using a horizontal bead mill filled with 0.3 mmφ zirconia beads at a volume ratio of 60% (~~System~~ Zeta-mini SYSTEM ZETA-MINI, manufactured by Ashi-zawa Finetech Co., Ltd.) to obtain Yellow Pigment Dis-

persing Element 1. The average particle diameter of the obtained yellow pigment was 112 nm.

Please replace the paragraph that begins on page 64, line 7 with the following replacement paragraph:

All additives described above were mixed and dispersed using a horizontal bead mill filled with 0.3 mm ϕ zirconia beads at a volume ratio of 60% (~~System Zeta-mini~~ SYS-TEM ZETA-MINI, manufactured by Ashizawa Finetech Co., Ltd.) to obtain Cyan Pigment Dispersing Element 1. The average particle diameter of the obtained cyan pigment was 87 nm.

Please replace the paragraph that begins on page 64, line 20 with the following replacement paragraph:

All additives described above were mixed and dispersed using a horizontal bead mill filled with 0.3 mm ϕ zirconia beads at a volume ratio of 60% (~~System Zeta-mini~~ SYS-TEM ZETA-MINI, manufactured by Ashizawa Finetech Co., Ltd.) to obtain Black Pigment Dispersing Element 1. The average particle diameter of the obtained black pigment was 75 nm.

Please replace the paragraph that begins on page 76, line 30 with the following replacement paragraph:

As is apparent from Table 2, it is proved that the present invention, providing a heating and pressurizing process after image printing, and a surface layer thickness after a heating and pressurizing process of 50 – 80% compared to that of before printing, is superior in Scratch Resistance, Scratch Resistance at High Humidity, Cracking Resistance at High Humidity, Glossiness and Bronzing Resistance, compared to the comparative examples. Of these, it is proved that extremely desirable effects were obtained in samples in which ~~B/F~~ B:F of the surface layer is set in the range of ~~2/8—8/2~~ 2:8 – 8:2, the average void ratio of the total ink absorbing layer is set to 40 – 70% and the surface layer void ratio is set to 30 – 70%, or images are formed using pigment ink.

Please replace the paragraph that begins on page 77, line 15 with the following replacement paragraph:

Under Output Condition 1, on none of the outputted images of this invention, were beading and color bleeding observed, resulting in high quality images. Further, under Output Condition 2 of the high rate output conditions, on the images using Recording Medium 1, beading and color bleeding were observed in numerous places. The image quality was unacceptable as viable photographic images. With the method of using Recording Medium 1, image defects such as partial image peeling was noted, and stains were also observed on the pressurizing device. On the contrary, the outputted images using the recording media containing silica in the surface layers of this invention did not at all suffer from beading and color bleeding, or only to a very slight degree, resulting in highly viable image quality. Specifically, on the examples using a thermoplastic ~~resin~~ resin: a filler of ratio in the range of ~~2/8—8/2~~ 2:8—8:2, beading and color bleeding were rarely observed, while the image quality was good. Further, on those ~~images~~ images, defects such as layer peeling were not noted at all.

Please replace the paragraph that begins on page 78, line 11 with the following replacement paragraph:

Further, ~~in~~ prior to printing onto the recording medium under atmospheric conditions of 25 °C and 50% RH, the recording medium was transported through a printer without printing to evaluate cracking of the unprinted recording medium, which showed no cracking. A similar evaluation was conducted under atmospheric conditions of 15 °C and 20% RH, showing that only on Recording Medium 7, having a high void ratio, 1 – 3 thin crack lines were generated per 10 cm in the transport direction. As a result, it is proved that Recording Medium 7 exhibited image defects, when transported under low temperature and low humidity.

Please replace the paragraph that begins on page 78, line 22 with the following replacement paragraph:

Based on the present invention, it is possible to provide an ink-jet image forming method[[of]] excellent in scratch re-

sistance of printed images, image cracking resistance when stored under high humidity, scratch resistance under high humidity, excellent glossiness and bronzing resistance.